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A Comparative Study of the Speech Developments of Japanese and American English in Childhood (Part Three)*

—The Re-organization Process of Babbling Articulation Mechanisms—

Sei NAKAZIMA

SUMMARY

We recorded the speech sounds of six Japanese and four American infants in Japan, and one American infant in the U.S.A., all of whom were about eight months to seventeen months old. We then compared the re-organization process of babbling articulation mechanisms of the three groups.

From the age of about nine months, infants begin to use their simple meaningless sounds as a means of evocation and response to voice stimuli. Before that, they utter, not as a means of communication, but alone, playing with their articulatory organs at the level of babblings. We think they begin to re-organize their babbling articulation mechanisms at the level of language from about nine months of age. This is the first step of the re-organization process. From about ten months of age, they begin to imitate adults' voices actively. This is the second step of the re-organization process. In the third step they develop cognition of external voice stimuli. From about eleven or twelve months of age, they begin to use a few conventional words; this is the fourth step.

At the beginning of the re-organization process, infants utter very simple meaningless sounds or repetitive babblings. When they begin to use words, they can not articulate correctly even bilabial plosives, which are articulated frequently at the babbling, especially at the repetitive babbling stage. They utter the words in various articulatory forms very actively and in various situations until about seventeen months. For example, they articulate /p/ in /papa/ not only [p] but also [b], [m], even [t], [k] etc., and they use /papa/ not only for their father but also for their mother, maid, other male adults etc. They end the re-organization process at about seventeen months of age and begin phonemicization and symbolization process after that. As for these basic tendencies of the re-organization process, we do not find significant differences among three groups.

I. INTRODUCTION

In former articles, (Nakazima, S., 1962, 1965/1966), we described the developmental process of the articulation mechanism and of speech behavior in the cases

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Table 1. Subjects and Recording Conditions.

Nationality	Place where S's voices were recorded	Subjects (Sex)	Beginning of recording by taperecorder	One recording per
Japanese	Kyoto, Japan	E.T. (f)	28 days (0 : 0, 28)	1 wk.
		Y.S. (f)	2 mos. (0 : 2)	2 wks.
		Y.N. (f)	1 mo. (0 : 1)	2 wks.
		H.K. (m)	1 mo. (0 : 1)	2 wks.
		T.T. (m)	7 mos. (0 : 7)	2 wks.
		T.Y. (m)	1 mo. (0 : 1)	2 wks.
American	Kyoto, Japan	G.M. (f)	3 mos. (0 : 3)	2 wks.
		F.P. (f)	6 mos. (0 : 6)	2 wks.
		E.D. (m)	7 mos. (0 : 7)	2 wks.
		C.W. (m)	6 mos. (0 : 6)	2 wks.
American	Champaign, Illinois U.S.A.	C.C. (m)	6 mos. (0 : 6)	2 wks.

of both Japanese and American infants ranging in age from birth to about fourteen months. In this article, we are going to make clear the characteristic feature of speech development in the course of language development during the period from about nine months to about seventeen months.

II. PROCEDURES

The subjects were three female and three male Japanese, and two female and two male Americans who were living in Kyoto, Japan, and one male American who was living in the U.S.A., shown in Table 1. We recorded on tape speech sounds of each subject at his home and described the situations in which he spoke and behaved. Each recording took about half an hour. We analyzed these speech sounds on a soundspectrograph.

III. RESULTS AND DISCUSSIONS

In the former articles, we described that infants began to utter calm non-crying voices from about one months of age, that they began to change pitch and articulatory forms of non-crying voices from about two months, that from month to month they increased the variety of pitch and articulatory forms and uttered so-called repetitive babblings at about six, seven, or eight months, and that they tended to decrease repetitive babblings and to develop prelinguistic communication in sounds, i.e. responses to voice stimuli and evocations in simple sounds, from about nine months. Before nine months they uttered sounds not as a means of communication but rather as if playing with articulatory organs. And we thought as follows: Before nine months, infants' utterances can be considered as one kind of what Piaget called "circular reactions", especially the repetitive babblings as one kind of "secondary circular reactions" (Piaget, J., 1950, 1953). At about nine months, infants

begin to co-ordinate various kinds of behavior patterns concerning speech, as "secondary circular reactions schemata", and apply them to new situations—language (Nakazima, S., 1962, 1965/1966).

At first, we would like to emphasize that the turning point in the course of speech development is at about nine months of age. As mentioned, before nine months infants utter sounds not as a means of communication but as circular reactions. Therefore we would like to characterize the development of articulation before nine months as *the development of articulation mechanisms at the level of babblings*.

After nine months of age, the development of articulation mechanisms at the level of babblings still continues, and on the other hand, as we described, from about nine months, infants develop prelinguistic communication in sounds. They begin to call to familiar persons and to respond to familiar persons' calling, actively uttering simple meaningless sounds, e.g. [ə], [a] etc. Then, we would like to characterize the turning point at about nine months of age as the beginning of *re-organization process of babbling articulation mechanisms*. Infants begin to re-organize the babbling articulation mechanisms at the level of language. Until this age, they have developed rather complex articulation mechanisms and have uttered various kinds of sounds at the level of babblings. But they start their re-organization process from the beginning, i.e. simple sounds.

At about ten months of age, as described, infants begin to imitate adults' voices actively (Nakazima, S., 1965/1966). We think this is the second step of the re-organization process of babbling articulation mechanisms.

As the third step of the re-organization process, we would like to point out the developmental process of infants' cognition of external voice stimuli (Nakazima, S., 1962, 1965/1966). As Tatsuro Yatabe stated (Yatabe, T., 1949), at the beginning of their infancy, we suppose, infants cannot discriminate between external voice stimuli. Parents' voices should be undifferentiated for them. Through the period of babblings they utter sounds in various articulatory forms and hear their own varied sounds. By the end of the babbling stage, i.e. about eight months of age, this kind of experience gradually makes them able to hear external sounds as differentiated stimuli. The differentiation of external sounds as stimuli by articulation-hearing practices at the level of babblings underlies the development of cognition of external voice stimuli.

At about eleven or twelve months of age, infants begin to use a few conventional words (Nakazima, S., 1962, 1965/1966). We think this is the fourth step of the re-organization process. In the former articles, we suggested that the development of phonemicization took place from the age of about one year. We would now like to modify this statement. We think that the re-organization process of babbling articulation mechanisms still continues through several months after one year of age and that after this period, i.e. from about seventeen or eighteen months of age, the phonemicization process develops (see Table 2).

Table 2. Development of Speech, by S. Nakazima, and Development of Sensorymotor Adaptations, by J. Piaget.

Age	Development of Speech	Development of Sensorymotor Adaptations
Year Month		
0 : 0	Infants cry when they are in a state of discomfort.	1. The first stage : The use of reflex.
0 : 1	Infants utter non-crying calm voices when they are comfortable. They sometimes respond in voices when they are called.	2. The second stage : The first acquired adaptations and the primary circular reactions.
0 : 2	<i>Development of articulation mechanisms at the level of babbling.</i>	
0 : 3		
0 : 4		3. The third stage : The secondary circular reactions and the procedures destined to make interesting sights last.
0 : 5		
0 : 6	Repetitive babbling.	
0 : 7		
0 : 8		4. The fourth stage : The coordination of the secondary circular reactions schemata and their application to new situations.
0 : 9	<i>Re-organization of babbling articulation mechanisms and their application to language.</i> Infants tend to decrease repetitive babblings and to develop prelinguistic communication in simple sounds.	
0 : 10	↓ Infants develop imitation in voices.	
0 : 11	Infants begin to use words. But these words do not work as language.	
1 : 0	They utter word-sounds and meaningless sounds in various articulatory forms, in various situations, actively.	5. The fifth stage : The tertiary circular reactions and the discovery of new means through active experimentation.
1 : 1		
1 : 2		
1 : 3		
1 : 4		
1 : 5	↓ <i>Phonemicization and symbolization of speech sounds.</i>	
1 : 6		6. The sixth stage : The invention of new means through mental combinations.
1 : 7		
1 : 8		
.		
.		
.		

We will now make clear the process after about one year. Let us see the differentiation process of bilabial plosive articulatory forms, /mamma/ (food), /mama/ (mother), /papa/ (father), /baibai/ (bye-bye), in the case of a female Japanese (shown in Table 3, 4, Fig. 1). These kinds of bilabial plosives appeared frequently during

the period of babblings, especially repetitive babblings. Nevertheless, when she tried to imitate her mother's voices at nine and ten months, she responded in repetitive babblings or in plosives other than bilabials.

When she was one year old her father was in England. Her mother showed her father's picture and taught her /papa/, [papa] with a falling intonation. She tried to imitate her mother but she did not articulate bilabials, except in whisper. One week later, i.e. at the middle of twelve months, she articulated the [p] sound. After that she uttered /papa/ actively in various articulatory forms for several months. As a matter of fact, as we stated (Nakazima, S., 1962, 1965/1966), we cannot describe these various kinds of sounds with phonetic alphabets. We show some of them in sonagrams (Fig. 1). These sonagrams show how varied the sounds are. As for the consonant /p/, she articulated not only [p], but also other bilabials [b], [m]. She, also, articulated other plosives [t], [k], [ʔ], and even fricatives like [w], [hw] (Table 3.2, 4). As for the vowel /a/ (Table 3.3, 4), she articulated fewer variations than for the consonant /p/. Most of the vowel sounds uttered by her were [a] and [ə]. Both of them could be grouped as the Japanese vowel /a/. /papa/ is a word of two syllables. But as shown on Table 3.1, 4, she uttered one, two, three and more, even eight, syllable-sounds. Her mother taught her /papa/ with a falling intonation. But as shown on Table 3.4, she uttered them with a falling, a flat, or a rising intonation. At thirteen months of age, she articulated /papa/ correctly. But even after that she uttered /papa/ in various articulatory forms.

Table 3. Developmental Process of /papa/, by a Japanese Female, E.T., and by an American Male, E.D. Figure, except average number of /papa/ utterances, shows percentage.

B : Beginning M : Middle E : End

3.1. Number of Syllables, uttered.

Age	Case of E.T., Japanese				Case of E.D., American			
	Average number of /papa/ utterances for thirty minutes	Number of syllables, uttered			Average number of /papa/ utterances for thirty minutes	Number of syllables, uttered		
		one	two	three and more		one	two	three and more
1 : 0 B	10	30	60	10				
M	47	4	74	22				
E	17		65	35				
1 : 1 B	23	13	56	31				
M	11		91	9	10	20	80	
E	10		30	70				
1 : 2 B	12		42	58				
M	2			100	7	56	44	
E	6		83	17				
1 : 3 B	2		100					
E	4		50	50	5	20	80	
M	3		100					

3.2. Consonants, articulated.

Age	Case of E.T., Japanese					Case of E.D., American				
	[p] only	include [b] or [m]	include [t] or [k] or [ʧ]	include [ʍ] or [h]	include a case of a consonant lacking	[p] only	include [b] or [m]	include [t] or [k] or [ʧ]	include [ʍ] or [h]	include a case of a consonant lacking
1 : 0B	20		40	30	10					
M	28	57		8	7					
E	29	41	30							
1 : 1B	26	61			13					
M	73	27					10	50	20	20
E	80	20								
1 : 2B	42	58								
M	100					28	44			28
E	83				17					
1 : 3B	100									
M	100					100				
E	100									

3.3. Vowels, articulated.

Age	Case of E.T., Japanese			Case of E.D., American		
	[a] or [ə]*	include [æ]	include [o] or [ū] or [u]	[a] or [ə]**	include [æ]	include [o] or [ū] or [u]
1 : 0B	80	20				
M	89	4	7			
E	71	23	6			
1 : 1B	100					
M	100			100		
E	100					
1 : 2B	100					
M	100			100		
E	100					
1 : 3B	100					
M	100			100		
E	100					

* In the Japanese phoneme system, [a] and [ə] are considered to be single vowel /a/.

** In the (American) English phoneme system, /a/ and /ə/ are considered to be different vowels. To compare the case of a Japanese with that of an American, we treated [a] and [ə] as one item.

3.4. Intonation, uttered. (cases of two syllables only)

Age	Case of E.T., Japanese			Case of E.D., American		
	falling↘	flat→	rising↗	falling↘	flat→	rising↗
1:0B	10	50				
M	10	60	4			
E	24	35	6			
1:1B	9	43	4			
M	9	82		50	20	10
E	10	10	10			
1:2B	26	8	8			
M						
E			83	28		16
1:3B	50	50				
M	50			80		
E	100					

/papa/ was taught to both of them with a falling intonation.

3.5. /papa/, uttered in various situations.

Age	Case of E.T., Japanese				Case of E.D., American			
	imitated	spontaneously uttered			imitated	spontaneously uttered		
		correctly used	incorrectly used*	uttered when S was alone**		correctly used	incorrectly used*	uttered when S was alone**
1:0B	60		10	30				
M	2	36	26	36				
E		6	71	26				
1:1B		35	52	13				
M	9	45	36	9	100			
E	10	10	40	40				
1:2B		67	33					
M			100			44	28	28
E			100					
1:3B		50	50					
M		75	25			60	40	
E		100						

* Subjects uttered /papa/ for mother, maid, male adults other than father, etc. in place of father.

** Subjects uttered /papa/-like sounds without certain relations to any objects when they were playing alone.

She uttered /papa/ not only in various articulatory forms, but also in various situations (Table 3.5, 4). At first she pointed at her father's picture and uttered /papa/ sounds, then she uttered them pointing at a male adult picture on a newspaper, and even at a microphone, at a tooth brush, at a toy dog etc. She uttered them rather actively when she was playing alone and without relations to any particular objects. When she was fourteen months old, her father came home. Transfer from the relation of /papa/ with father's picture to the relation with father himself was easily done. After that she uttered /papa/ sounds to a male adult other than her father, and even to her mother and to her maid. When she was thirteen months old, /mama/ (mother) was taught to her by her maid. She confused /papa/ and /mama/. She confused /papa/ and /jo:ɬɕan/ (the name of her maid), too. This kind of confusion among /papa/, /mama/, and /jo:ɬɕan/ became greater after her father's coming home. For example, when she met one of them, she uttered /papa/ or /mama/ or /jo:ɬɕan/ at random. Then, when she was neglected, she tried to utter another name, and thus she finally reached at the correct one. When she was eleven months old, /wanwan/ (bow wow) was taught to her, and when thirteen months old, /njannjan/ (kitty) was. She confused /papa/ and /wanwan/, /njannjan/, too. For example, she uttered /wanwan/ sounds to her father's picture and mixture sounds of /papa/ and /wanwan/ to a toy dog at thirteen months of age, and mixture sounds to her father at fourteen months.

After these spontaneous and very active trials, when she was seventeen months old, she uttered /papa/ with correct articulation and in a correct situation.

Then, let us see the developmental differentiation of /mama/ (mother) and /mamma/ (food). When she began to imitate her mother's /mamma/ intentionally, at nine months of age, she responded in repetitive babblings. At eleven months and even twelve months, when she was hungry, she did not utter /mamma/, but cried or shouted in meaningless sounds. Only after she ate some cookies or other things, she imitated or uttered spontaneously /mamma/ sounds. After thirteen months of age, she did not cry but uttered /mamma/ sounds. When she was thirteen months old, /mama/ was taught to her. But she uttered [mamma]-like sounds in place of [mama]. When she was fourteen months old, /mama/ became differentiated from /mamma/ in articulation. /mamma/ means food in general in Japanese baby-talk. Also, she used /mamma/ for everything to eat or to drink. When she was sixteen months old, /ɬɕa/ (tea) became differentiated from /mamma/, when seventeen months, /mifukur (milk) was also differentiated.

When she was eleven months old, she learned /wanwan/ (bow wow). This, too, she uttered in various articulatory forms and in various situations (Table 4. Fig. 1).

During the first several months of the second year, she tried to imitate her mother's voices actively. But it was not so easy for her to articulate bilabials and other plosives, which were articulated frequently by her at the babbling stage.

We show some of them on Table 4, Fig. 1.

We would now like to compare the case of the Japanese with the case of an American. As shown on Table 3, 5 and Fig. 2, the case of a male American shows almost the same developmental tendency as the case of the Japanese. When he began to imitate adults' voices intentionally, at nine and ten months of age, he did not articulate bilabials and other plosives. When he was thirteen months old, /papa/ was taught to him. But he did not articulate bilabials. After trials of imitation of /papa/, he uttered it in various articulatory forms and in various situations, though his utterances were not so varied as those of the Japanese infant. He learned /bauwau/ (bow wow) when he was twelve months old. He uttered it in various articulatory forms and in various situations, too. He also showed some kind of mixture of /papa/ and /bauwau/. English /bauwau/ is different from Japanese /wanwan/ in articulatory forms. But /bauwau/ sounds articulated by him cannot be distinguished from the /wanwan/ sounds articulated by the Japanese. During the first several months of the second year, he tried to imitate adults' voices actively. But it was not so easy for him either to imitate bilabials or plosives correctly. After these active trials, when he was seventeen months old, he uttered a few words in nearly correct articulatory forms and in correct situations.

Let us now see a few cases of American infants; two Americans, living in Japan (Table 6, 7 and Fig. 3, 4), and an American, living in the U.S.A. (Table 8 and Fig. 5). Key words used by infants during the first several months of the second year are different from case to case, i.e. /dada/ (thank you) with a rising intonation by a male, /mama/ (mother) by a female, /lait/ (light) by a male. They uttered these words very actively in various articulatory forms and in various situations. They, too, tried to imitate adults' voices. Also in these cases to articulate bilabials correctly was not easy. As for these tendencies, we do not find significant difference between American infants in Japan and the American infant in the U.S.A.

Thus, infants utter these few words in various articulatory forms and in various situations. This means they are trying to re-organize babbling articulation mechanisms on the level of language. They practice this kind of trials very actively, using not only conventional meaningful words, but also meaningless sounds. A Japanese male infant, when he was eleven months old, after trials of imitation of his mother's [hahaha] (one kind of laughing sounds), uttered [haha]-like sounds in various articulatory forms and in various situations. And he sometimes actively talked to his parents uttering meaningless sounds, articulated rather at random by himself (Nakazima, S., 1965/1966). We show a few examples of other cases on Table 4, 5 and Fig. 1, 2.

Natsuki Okamoto stated as follows: When a female infant was about eleven to thirteen months old, she used a few certain sounds (words) transpositively. But these sounds were not uttered as the names of a few objects. Rather, these sounds were connected with pre-concept in her. Through the repetition of the transpositive

use of such a few early sounds, she found that she could produce the representational correspondence between her own sounds and the world (situation). This kind of general basic set to rule her own sounds as her own representational means is the basis of the verbal symbolic function. Such a basic set is generalized rapidly and becomes the ground on which many words are built up. At this stage, her comprehension and spontaneous use were not yet integrated, i.e. her mother taught her dogs as /wanwan/ (bow wow) but she uttered /njannjan/ (kity) spontaneously for dogs (Okamoto, N., 1962).

Jun-ichi Murai stated: The analytic factor study concerning infants' behavior development by himself and Yasunori Maruyama shows that the factor involving the test time "uttering three or four words" has large factor loading in some intelligence items and the factor involving the test item "understanding the mother's verbal orders" has large factor loading in some motor items (Murai, J., 1963/1964).

We agree with Okamoto's opinion. But we would like to emphasize infants' active spontaneity. From the beginning of infancy they express their own emotion, though undifferentiated, in whole body action accompanying crying. From month to month, from day to day, infants' sensorymotor functions become gradually differentiated and organized through maturation and practice. Sensorymotor functions concerning speech, also, become differentiated and organized. As already stated (Nakazima, S., 1962), infants' interest to the external world, including voices, becomes differentiated through experiences. Based on this kind of differentiation, external world becomes differentiated as cognizable stimuli. Based on practice and maturation of speech organs and hearing organs through the period of babblings, infants' expression in voices become differentiated from bodily emotional expression, and external voices become differentiated from other external stimuli, and then become differentiated each other. Then, from about eleven or twelve months of age, infants pick up a few of their parents' sounds, both meaningful speech sounds and meaningless sounds, and try to use them as means of expressing what they want to express very actively. They use not only these sounds so learned but also those which are articulated by themselves rather at random. We have showed some of these examples. We would like to add one more example. When the female Japanese was thirteen months old, she used /ija/ actively. When she had been kept alone and wanted to play with someone she uttered /ija/. /ija/ means "no". Therefore, conventionally, when someone wants to deny or refuse anything he uses it. Nevertheless, she did not use it negatively, but used it rather positively.

Okamoto also stated: "in infant's transpositive use the objects are assimilated selectively according to the affective similarity" (Okamoto, N., 1962). We agree with his opinion. But infants' ways of using voices, we think, are not so simple and linear as he stated. They use their voices freely in many ways. Sometimes they seem to be confused, disordered, even in chaos. We think these kinds of active, spontaneous practices are very important for infants' speech development. Through

these practices infants finish the re-organization process of babbling articulation mechanisms at the level of language and start phonemicization and symbolization process of speech. But, as Okamoto and Murai stated, at this age level speech perception and speech production are not yet integrated.

We will describe the phonemicization and symbolization process in the next article.

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Table 4. Speech Development of E.T., a female Japanese.

F : father M : mother m : maid S : subject

B : beginning M : middle E : end

Age	Situations	Speech Sounds* ¹
0 : 9	M said to S [mamma wa].* ² Thirty-five minutes after it, S uttered :	[mmammammammammam]* ³
0 : 10	Responses to M's [baibai wa]* ⁴ :	[ʔaɪ], [bæbæbæbæ]* ³
0 : 11 B	Response to M's [mamma wa] :	[p'amaa]
	Fifteen minutes after M's [wanwan te]* ⁵ :	[ʔhawwa]
	After a while, S uttered :	[wawha]
M	When S looked at M bringing cookies, S cried. After S ate some of cookies, S imitated M's [mamma] :	[əməmməmma]* ³
	After S ate cookies S began to play alone. While playing alone, S uttered :	[amammə]
E	Response to M's [wanwan te] :	[wawwa] in whisper
	After a while, when S was trying to stand alone, S uttered :	[a:ūwa]
1 : 0 B	M showed S a picture of F and tried to let S imitate her ; responses to M's [papa wa]* ⁶ :	[ʔaʔa], [hwa ʔa], and [baba] in whisper
M	When S looked at m bringing cookies, S shouted in meaningless voices. After having eaten cookies, S uttered spontaneously :	[mam mammə]
	Response to M's [mamma wa] :	[mammammamma]* ³
	M showed S the picture of F and talked with S ;	
	M : "Who is this?" S :	[ba papa]
	M : "Who?" S :	[papwo]
	M : "Yes, it's papa." S :	[apapa]
	Pointing at the picture of F, S uttered :	[mapa]
	After a while, when S was playing alone, S uttered without certain relations to any objects :	[bapa pa:wa]* ⁷
	Pointing at a microphone, S uttered :	[bapapa]
	Pointing at the picture of F, S uttered :	[əba:ba]
	Pointing at a man's picture on a newspaper, S uttered :	[ata p'əpa]* ⁷
	M showed S the picture of F and asked [kofe wa].* ⁸ S :	[kakka]

*¹ These speech sounds are not the same as those described by the phonetic alphabets but only roughly similar to them. Refer to their sonagrams, in Fig. 1.

*² [mmamma] and [mamma] mean "food" in Japanese baby-talk. [mamma wa] means "Say mamma".

*³ Responses in repetitive babblings.

*⁴ [baibai] means "bye-bye".

*⁵ [wanwan] means "bow wow" in Japanese baby-talk. [wanwan te] means "Say wanwan".

*⁶ [papa wa] means "Say papa". This is the first time M taught S the word /papa/, in falling intonation. At that time F was in England. F came home when S was fourteen months old.

*⁷ Two-word sentence-like sounds.

*⁸ [kofe wa] means "What is this?".

- While playing alone by M, S looked at M and uttered without relations to a dog : [wauwɔa]
 Response to M's [wanwan] : [jaujə]
 Response to M "Let's play with a toy dog." : [hweɛwe]
 When playing alone, S uttered like a monologue : [aujə]
 When playing alone with a toy dog, S uttered : [aɪwa waɪwa]*7
 Response to M's [tatta]*9 : [tæ:]
- E M showed S a toothbrush and asked her ;
 M : "What is this?" S answered : [tata]
 M : "No, it's not papa."
 While playing alone, S uttered monologue like sounds : [taka]
 Trying to take M's cookies, S shouted : [bapa]
 S found a toy dog and uttered : [mapapaka]
 M : "No, it's a bow wow." S responded : [aũa bapapa]*7
- 1 : 1 B S pointed at the picture of F and uttered : [mapapa: papa]*7
 S looked at the F's picture and uttered : [papa]*10
 S looked at m bringing cookies and uttered : [mam:mam:mama]*11
 S looked at M and uttered : [mammaĩ]*12
 S stretched her arms toward a bicycle and uttered without any relations to M or food : [mamma]
 Responses to M's [wanwan wa] : [aɪwa:ĩwa], [a:va], [wa wanwanwaɪo]
 After a while, S looked at a taperecorder and uttered : [wauwɔa]
- M S looked at m bringing cups of tea and uttered : [mam:mam:]
 M showed S the F's picture and asked ; "Who is this?" S answered : [mamma]*13
 S pointed at the F's picture and uttered : [a:wauwɔa]*14
 S pointed at a painting of hens and uttered : [auɪxə]*15
- E While eating, S uttered : [mammamma:wɔ]
 S put a spoon into a glass, filled with milk, and uttered : [mamma]*16
 M showed S the F's picture and asked her ; "Who is this?" S answered : [papa]*17
 S was trying to sit on M's knees and uttered : [mapapa]
 M was not in S's room. S heard someone's foot-step sounds and uttered : [mama ma:ma]
 S tried to embrace M and uttered : [mami:mi:mi]

* 9 [tatta] means "Stand".

*10 This is the first spontaneous utterance /papa/, articulated correctly, but with a flat intonation.

*11 This is not a simple form of repetitive babblings, but seems three-word sentence-like sounds, with an accent on the first syllable.

*12 When S was thirteen months old, m taught S the word /mama/ (mother). /ɪnama/ was not differentiated from /mamma/.

*13 /papa/, /mama/, and /mamma/ were not differentiated.

*14 S confused /papa/ and /wanwan/, too.

*15 One kind of variations of /wanwan/.

*16 Correct articulation with a correct, i.e. falling, intonation.

*17 With a correct, i.e. falling, intonation.

	To M, S shouted :	[data]* ¹⁸
	S looked at a toy dog and uttered :	[mapa:wanwa]
	Response to M's [wanwan wa] :	[auwa wauwa]* ⁷
	M showed S a dog painting and asked ; "What is this ?" S answered :	[awauwa]
	M showed S a kitty painting and asked ; "What is this ?" S answered :	[nje:nnje]* ¹⁹
	Response to M's [me:me:]* ²⁰ :	[nje:m:]
	Responses to M's [mo:mo:]* ²¹ :	[o:], [a'uo:], [maime:]
	Response to M's [toto]* ²² :	[t'jotjo]
	Response to M's [kokko]* ²³ :	[k'ok'ok'o]
	M was reading a book by S. S wanted to play with M and uttered :	[ija]* ²⁴
1 : 2 B	M showed S the F's picture and talked with her ;	
	M : "Who is this ?" S answered :	[bapa]
	M : "Say papa." S :	[bapa]
	After a while, S :	[mapapa]
	M : "Yes, it's papa. You learned it." S :	[njennjennje]
	After a while, S :	[wauwau]
	F came into the room and asked S, "Who is this?" S answered :	[mapapapo:wouwou]
	M went out the room. S shouted :	[p'papa:wa]
	Response to M's [gohon]* ²⁵	[zo:ō]
	S was turning over pages of her book to find out a painting of dogs and uttered :	[wawouwouwouwouwou]
	Response to M's [me:me:] :	[wauwau]
M	M pointed at F and asked S, "Who is this?" S answered :	[mama] with a falling intonation* ²⁶
	When S was calling M, S uttered :	[mama] with a rising intonation* ²⁶
E	S went to F's room. S found F sleeping and uttered :	[papa njennje]* ²⁷
	S sit on M's knees and uttered :	[papa]
1 : 3 B	M pointed at F and asked S, "Who is this?" S answered :	[mama]
	F and M said, "No, it's papa." S said :	[mam]
	M said to S, "Papa, it's papa." S shouted :	[jɔ:tɕan]* ²⁸

*18 One kind of variations of /jɔ:tɕan/ (m's name). S confused /papa/ and /jɔ:tɕan/, too.

*19 M taught S the word /njannjan/. It means "kitty" in Japanese baby-talk.

*20 Means "goat" or "kid" in Japanese baby-talk.

*21 Means "cow" or "bull" in Japanese baby-talk.

*22 Means "bird" in Japanese baby-talk.

*23 Means "cock" or "hen" in Japanese baby-talk.

*24 /ija/ means "no" or "No, I won't". S uttered /ija/ when S was asking someone to do something, i.e. asking M to play with her or to hand over a toy to her, etc.

*25 Means "book" in Japanese.

*26 S differentiated /mama/ from /mamma/.

*27 [njennje] is one of the variations of [nenne]. [nenne] means "sleep". It is the first two-word sentence.

*28 One of the variations of /jɔ:tɕan/ (m's name).

M	F was going back to his room. S tried to follow him and uttered :	[papa]
1 : 4	S looked at a glass of water and uttered :	[mam:]
	M was drinking a cup of tea and asked [ot̚ɕa hoçii nɔ] (Do you want to drink a cup of tea?).	
	S answered :	[t̚ɕə]
	S drank a cup of tea and asked M :	[t̚ɕə]* ²⁹
1 : 5	S was hungry and said to M :	[mikiũ]* ³⁰

*²⁹ [ot̚ɕa], [t̚ɕa] means "tea". This [t̚ɕə] means "Give me another cup of tea".

*³⁰ One of the variations of [mifuuku], means "milk". It means "I want to drink a glass of milk".

Table 5. Speech Development of E.D., a male American, in Japan.
M : mother F : father S : subject N : Nakazima

Age	Situations	Speech Sounds* ¹
0 : 9	Responses to M's [dædædæ] :	[t'ejæ:t'ɕə], [kjækjækjæɕ]
0 : 10	Response to M's [dædædæ] :	[kjædjæ]
	Responses to N's [mmamma] :	[p'wba], [baba], [mma m:]
	Response to M's [baba] :	[mæmmammæ]
0 : 11	Response to M : "Pattycake" :	[atæke]
1 : 0	Response to N's [mmamma] :	[mammm]
	Response to M : "Bow wow wow" :	[mambə]
	S pointed at a dog picture and uttered :	[awwə]* ²
1 : 1	Response to N : "Papa" :	[ʔ'aʔ'a:]
	While playing alone, S uttered :	[ʔammaũ], [hbamm:], [mmmβwə]* ³
1 : 2	Response to N's [papa] :	[htjatja]
	Response to N's [mamma] :	[wawwə mamma]* ⁴
	Looking at a dog picture, S uttered :	[aãwa bara]* ⁴
	Looking at a horse picture, S uttered :	[bara wawwə]* ⁴
	Turning pages, S uttered :	[wawwə wawwə wa]* ^{2,5}
	Talking to M, S uttered :	[a wa wɪjaʔə]* ⁶
	Looking at a cow picture, S uttered :	[hawwa]* ²
1 : 3	Responses to N's [papa] :	[bapa], [waãp'a], [p'ap'a]
	Responses to M : "Shoes" :	[ɕɪ], [ɪ], [t'ɪ]
1 : 4	Looking at F, S uttered :	[papa]
	Response to M's [papa] :	[p'apa]
	Responses to N's [mama] :	[mamma], [mama]
	Looking at a dog picture, S uttered :	[baũwaũ]
	Responses to M : "Miaow" :	[mja:], [nja:], [na:]

*¹ Refer to their sonagrams, in Fig. 2.

*² One of the variations of "bow wow wow".

*³ Without relations to any particular objects.

*⁴ Two-word sentence-like sounds.

*⁵ Three-word sentence-like sounds.

*⁶ Meaningless sounds with conversation like intonation, including [wa] sound, a part of "bow wow wow".

Responses to M: "Car" :	[kũ:ɹ], [k'a:ɹ], [tɕa:ɹ]
Pointing at his shoes, S uttered :	[ɕɹjʊ:ɹ]
Looking at a sleeping dog picture, S uttered :	[namai], [njamjai]* ⁷
S was turning pages. M tried to let S speak.	
S said :	[o:ɳo:ɳo:]
After a while, S uttered :	[p'əp'ə]
M responded, "Book, book, yes, book."	

*⁷ Means "good night".

Table 6. Speech Development of C.W., a male American, in Japan.
M : mother S : subject

Age	Situations	Speech Sounds*
1 : 1	S was fond of giving an object to a familiar person and taking it back, saying /dada/ (thank you). Variations of /dada/ :	[djæ], [dedeɕ], [djo:dja] [djö:tɕə], [da:dzə], [ʔəʔə]
1 : 2	Response to M's "Baby" :	[eɪ]
1 : 3	Responses to M's "Birdy" :	[mə:ni], [əbü]

* Refer to their sonagrams, in Fig. 3.

Table 7. Speech Development of F.P., a female American, in Japan.
M : mother

Age	Situations	Speech Sounds*
1 : 0	Response to M's "Mama" :	[mamɹ]
1 : 1	Responses to M's "Mama" :	[vævæ], [djæjæ], [vaɪɹjə]
1 : 2	Responses to M's "Book" :	[mmə], [buɹzʊə], [ɣ:gi]

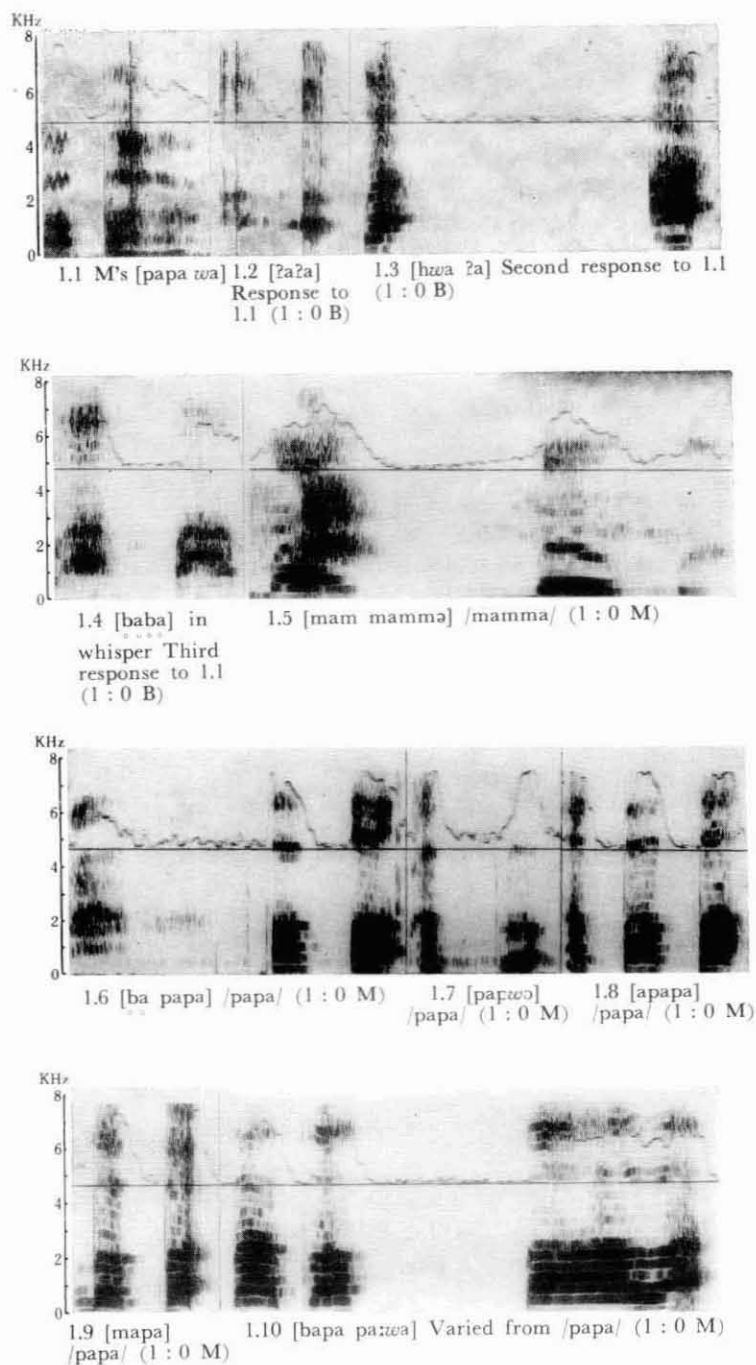
* Refer to their sonagrams, in Fig. 4.

Table 8. Speech Development of C.C., a male American, in the U.S.A.
M : mother S : subject

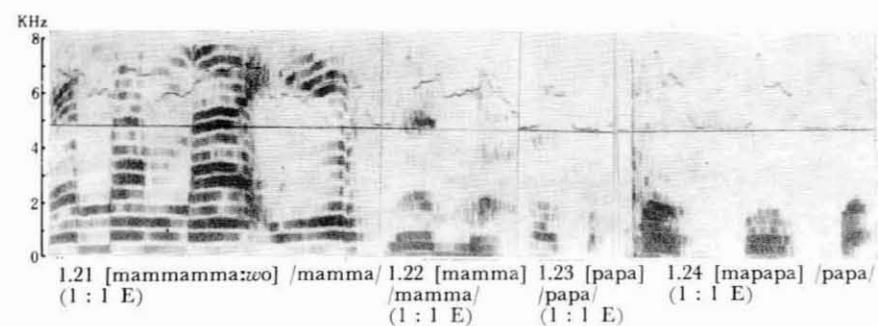
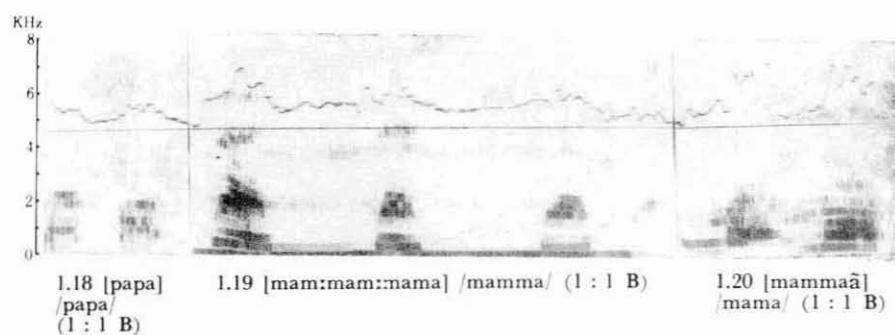
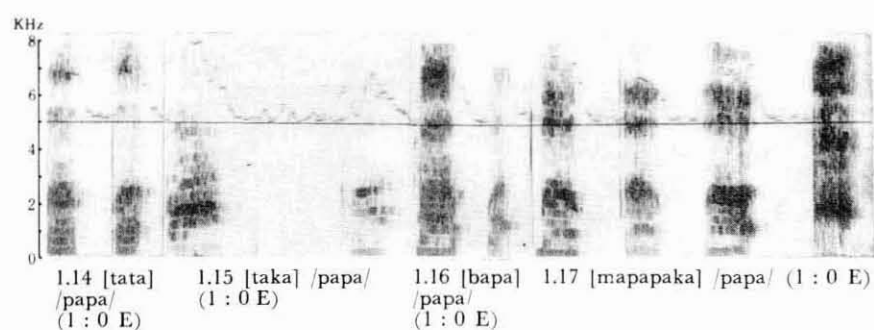
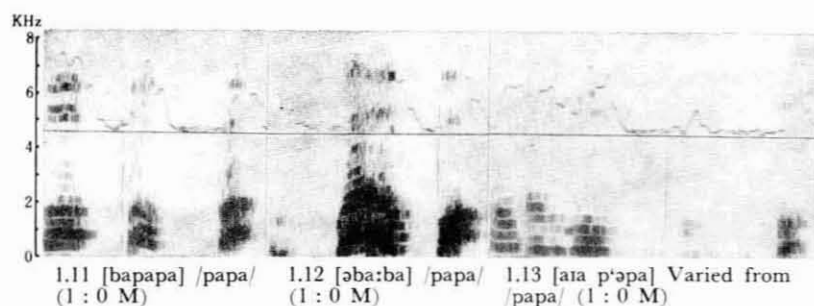
Age	Situations	Speech Sounds*
1 : 2	S uttered "light" spontaneously or in imitation. Variations of "light" :	[laɹtʃ], [laɹ], [aɹtʃ], [aɹ], [haɹtʃ]
1 : 3	S imitated M's "What's that ?" :	[hʊɹɪddæn]
	S imitated M's "Please" :	[bni:z]

* Refer to their sonagrams, in Fig. 5.

Fig. 1. Sonagrams of Speech Sounds of E.T., a female Japanese.
Refer to Table 4. M : mother B : beginning M : middle E : end



These sounds, shown on sonagrams, are not the same as those described by the phonetic alphabets, but only roughly similar to them, e.g. [a] means [a]-like sounds etc.



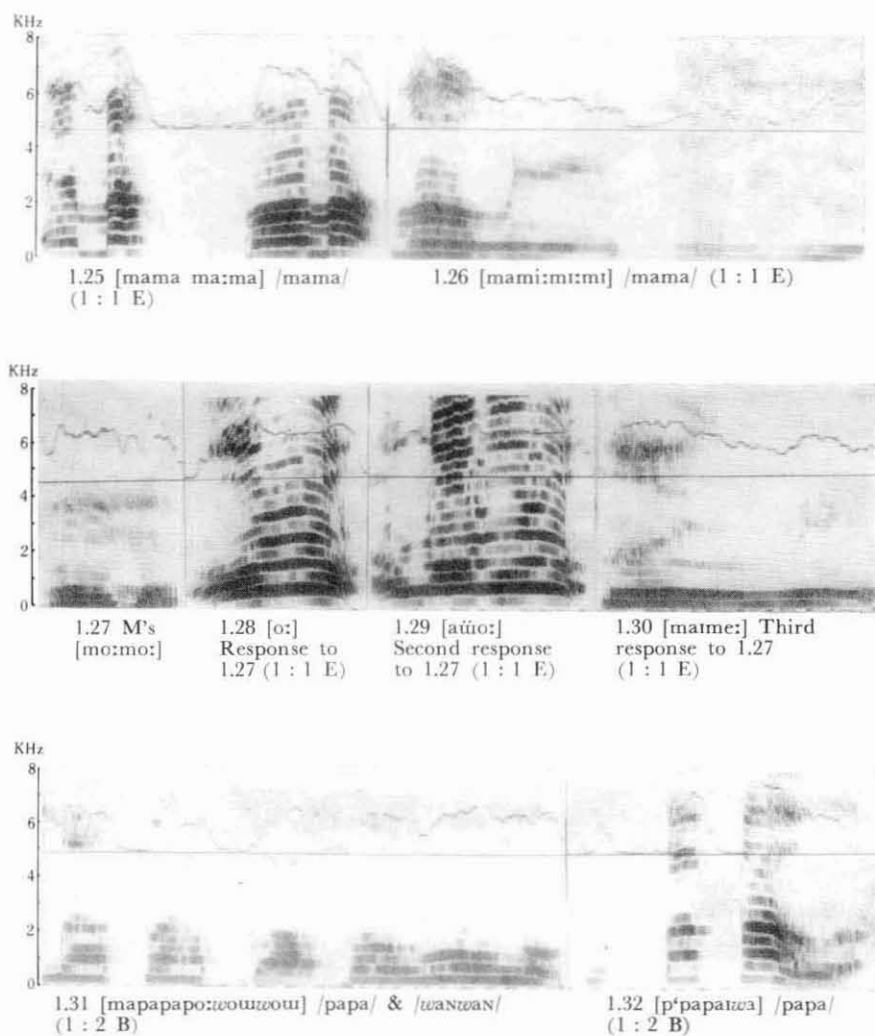
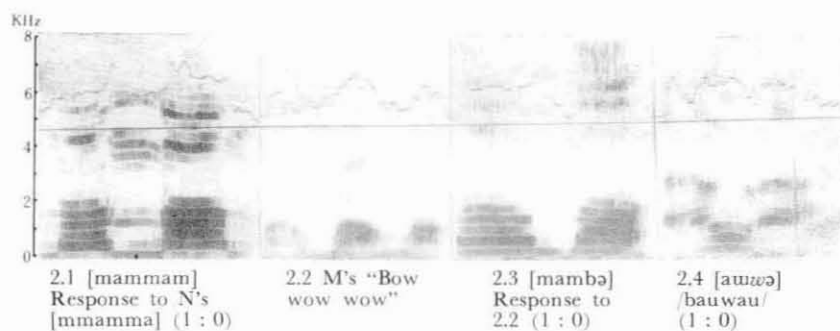
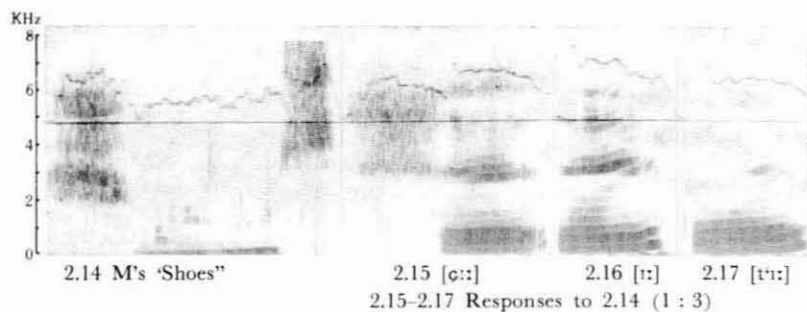
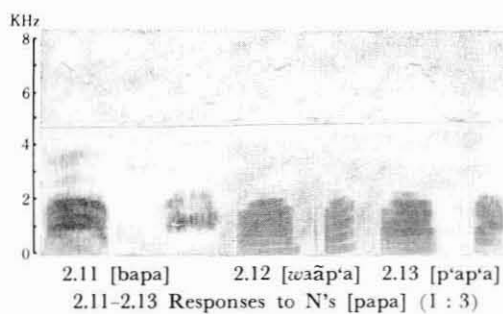
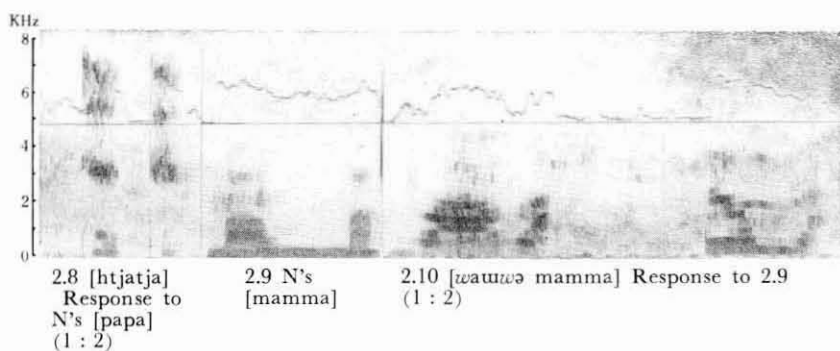
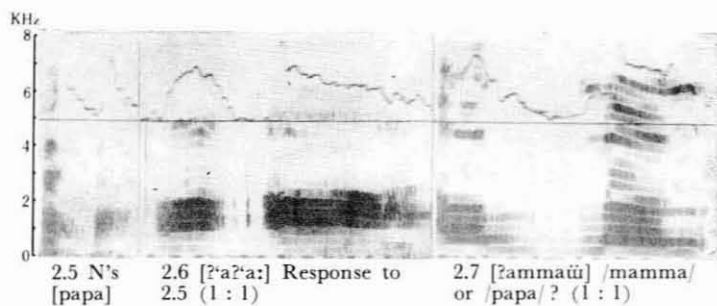


Fig. 2 Sonograms of Speech Sounds of E.D., a male American, in Japan.
Refer to Table 5. M : mother N : Nakazima





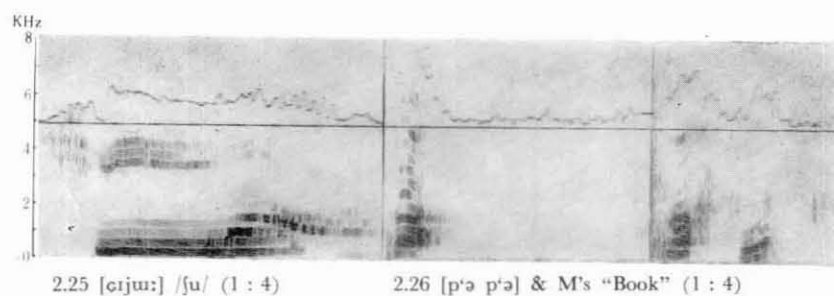
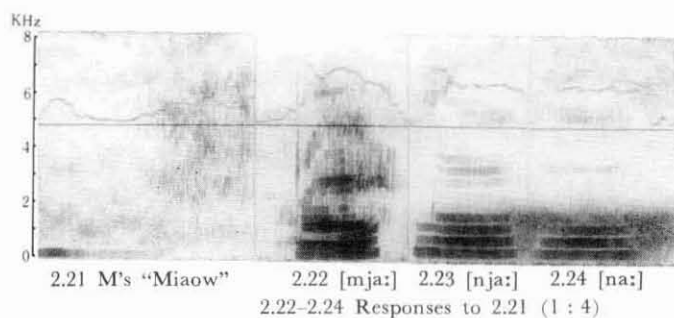
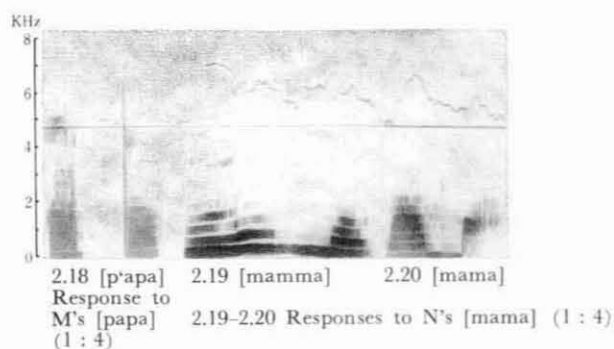
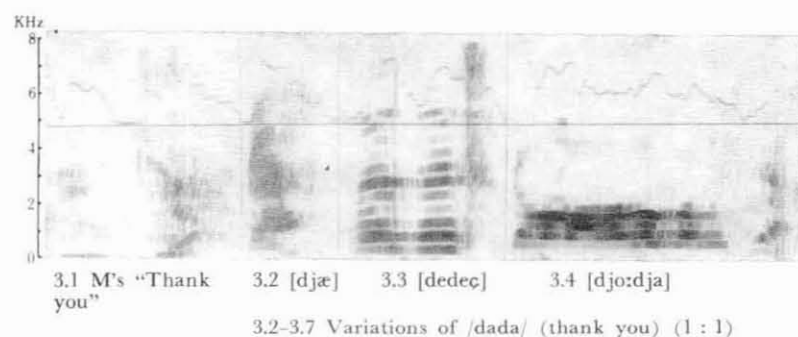


Fig. 3 Sonagrams of Speech Sounds of C.W., a male American, in Japan.
Refer to Table 6. M: mother



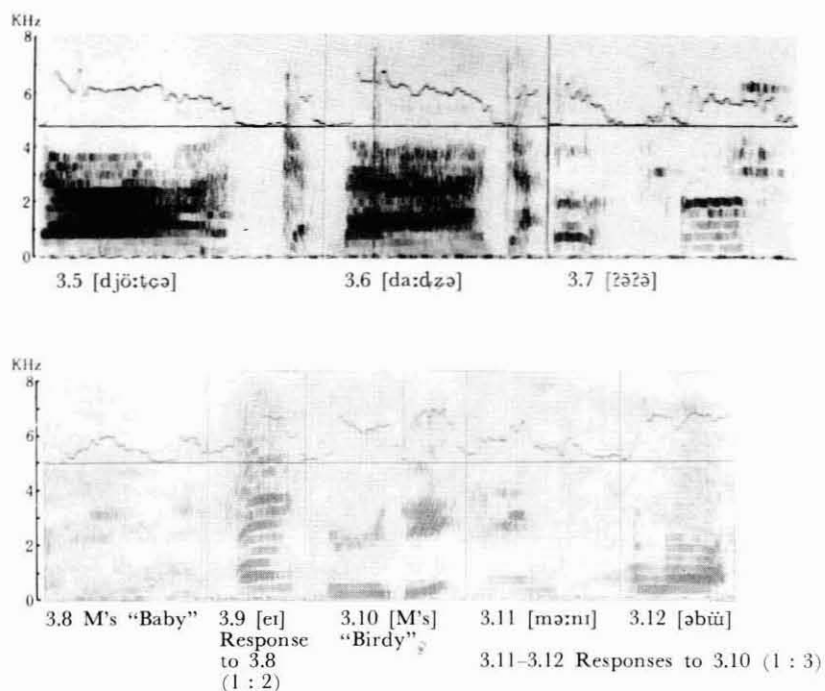


Fig.4 Sonagrams of Speech Sounds of F.P., a female American, in Japan.
Refer to Table 7. M : mother

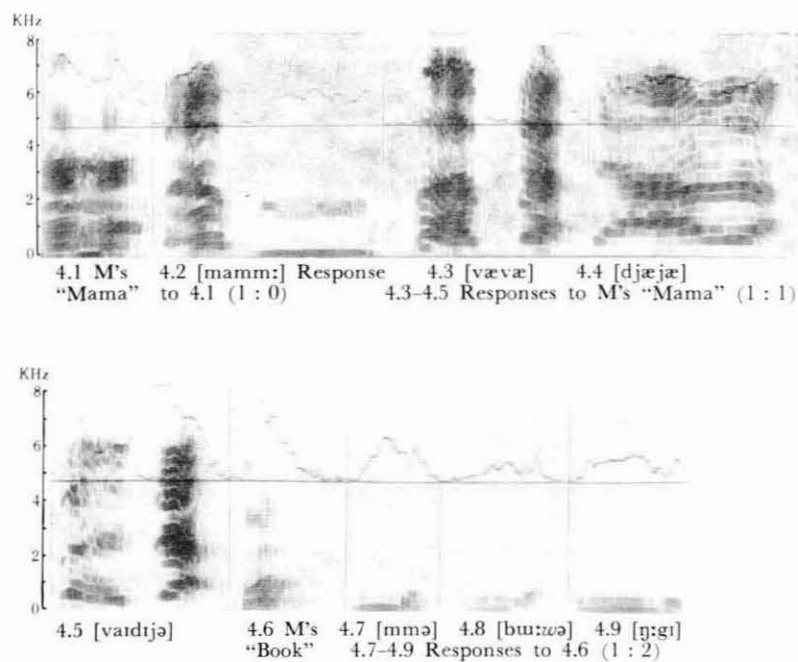


Fig. 5 Sonagrams of Speech Sounds of C.C., a male American, in the U.S.A.
Refer to Table 8. M: mother

